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TITLE:	ARRANGEMENT OF A SOUND HOLD ANDCONSTRUCTION OF A SOUND BOARD IN AN ACOUSTIC GUITAR
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ARRANGEMENT OF A SOUND HOLE AND CONSTRUCTION OF A SOUND BOARD IN AN ACOUSTIC GUITAR

The present application claims priority from U.S. Provisional Application 60/202,764, filed on May 9, 2000, the contents of which is herein incorporated by reference in its entirety.

The present application herein incorporates US patent application 09/005,104, filed January 9, 1998, by reference in its entirety.

Background of the Invention

Acoustic guitars are constructed so as to amplify the sound wave produced by the vibration of the strings, via a resonance body having a sound board. The sound wave created by the vibrating strings is introduced into the resonance body through the bridge provided on the sound board. Inside the resonance body, the sound wave is resounded and amplified within the resonance body.

Acoustic guitars typically include a round sound hole located in the sound board at a centered position in the waist and upper bout of the guitar body and underneath the strings of the instrument. The present invention has shown that this is not the optimum location for the sound hole in that the instrument is unable to deliver the clean, brilliant sound for the body sound box that is put into it in the form of vibration tones put in action by the bridge.

The input sound to the guitar body sound box can be heard by laying one's ear on the guitar sound board near the bridge. When this is done, one hears the clean, brilliant input sound. However, without one's ear on the guitar sound board, the normally heard output sound of the guitar is heard as a muddy sound, when compared to the input sound heard with the ear against the guitar.

To improve the sound quality of the guitar, attempts have been made to rearrange the sound hole in particular locations. An attempt has also been made to have a plurality of sound holes strategically located on the face of the guitar. Patents which disclose an irregular location of the sound hole, and are incorporated herein by reference in their entirety, include:

U.S. Patent No. 2,523,963 U.S. Patent No. 4,090,427

U.S. Patent No. 3,539,699
U.S. Patent No. 3,869,954
U.S. Patent No. 4,056,034
U.S. Patent No. 4,317,402
French Patent No. 2529363

The present invention is an improvement over the above-mentioned prior art in that it more effectively utilizes as much of the sound board as possible by positioning a single sound hole, or zone, in a specific location to optimize the vibration of the sound board.

Without limiting the scope of the invention in any way, the invention is briefly summarized in some of its aspects below.

Summary of the Invention

In accordance with the invention, a single sound hole, or zone, is located on the face of the sound board immediately adjacent to the upper side panel of the guitar extending approximately from the upper end of the bridge to the upper waist portion. The present invention more effectively utilizes as much of the effective part of the sound board as possible by positioning a single sound hole, or a plurality of holes, in a specific location, or zone, to optimize the vibration of the sound board.

Separately or in combination with the novel positioning of the sound hole, a sound board comprising one or more, most preferably no more than two, layers of wood bonded, preferably glued, together, wherein the grain direction of the layers are perpendicularly situated. Preferably the grains are in substantially parallel planes.

In addition, the sound board may be made of a plurality of layers, each layer being a different types of wood. Preferably, the grains of the separate layers are in parallel planes, wherein the grain directions are non-parallel. Among other attributes, this construction produces a distinctive and unique sound.

Brief Description of the Drawings

Figure 1 is a face view of an acoustic guitar according to the invention.

Figure 2 shows a face view of an alternative manifestation of the invention.

Figure 3 shows a face view of a guitar illustrating the optimum vibration area of the sound board.

Figure 4 shows a face view of a sound board with a cut out portion.

Figure 5 shows a cross-section of the sound board of Figure 3.

Figure 6 shows the approximate positioning of the single sound zone.

Figures 7a-c show various hole designs in the sound hole zone.

Description of the Preferred Embodiment

While this invention may be embodied in many different forms, there are described in detail herein specific embodiments of the invention. The present disclosure is an exemplification of the principles of the invention and is not intended to limit the invention to the particular embodiments illustrated.

Referring to Figure 1, this invention relates to an improvement in acoustic guitars such as the one generally indicated at 10 having a guitar body or sound box 12. Hollow body 12 has a waist generally indicated at 14 which identifies the narrowest portion or mid-section of the guitar. The portion of the guitar body above waist 14 is known as the upper bout and is generally designated in the Figure at 16. The portion of the guitar body below waist 14 is generally known as the lower bout and is generally designated in the Figure at 18.

The top, 22, seen in Figure 1 of guitar hollow body 12 is known as the sound board. The sound board 22, at its periphery, defines the edges of the upper bout 17, the lower bout 19 and the edges of upper 15 and lower 21 waist portions. The edges of the sound board are connected to side panels and in turn the rear panel to form the hollow body as is typical of guitars. As is conventional in guitars, a neck 26 is attached to hollow body 12 to extend over sound board 22 as shown. A bridge 28 is also anchored to sound board 22 to transfer vibrations into the sound board. Strings generally designated 30, including bass strings 30a, which are closest to the upper edge 15 of the waist, and treble strings 30b, which are closest to the lower edge 21 of the waist, extend along neck 26 and are received by bridge 28, thereby supporting strings 30 over sound board 22. Strings 30 are attached at the distal end of the neck 26 in any conventional manner known in the art, preferably in such a way to allow for tension adjustment of the

strings. The strings may be steel, gut or any other type string ordinarily used with an acoustic guitar.

According to the invention and as seen in figures 1-2, a sound hole 32 is formed in the sound board 22. In one embodiment, the location of this hole affects the sound produced by the guitar of this invention. Preferably, the hole is generally oval or kidney in shape in the preferred forms of this inventions as shown in Figures 1 and 2. Any shapes however, particularly an oblong one, may be utilized according to the invention to improve the sound produced by the guitar.

As can be seen in Figures 1 and 2, the hole, 32 and 34, is preferably positioned between the upper 16 and lower 18 bouts and between the edge 15 of the waist 14 and the bass strings 30a. The zone 32 and 34 is positioned distally from the bridge 28 and proximally from the proximal end of the neck 11. In the preferred form of the invention as depicted in Fig. 2, the hole will be located at the waist 14, and substantially aligned with the adjacent portion of the sound board edge.

The sound hole positioning in the present invention utilizes more of the sound board which has a greatest capacity for vibration. Fig. 3 illustrates this area 13, which is generally in the center of the sound board. The sound hole is positioned as much above this area as possible, immediately adjacent to the edge 15 of the waist 14. The sound hole may dip down into the area 13 slightly.

The position of the sound hole optimizes the surface area of the sound board while allowing maximum release of sound vibration from within the sound box. Such positioning of the sound hole allows the guitar to sustain longer sound vibration and avoids wave cancellation at lower frequencies.

The one sound hole, or zone, may be of alternative configurations or construction. In the alternative to one hole, a plurality of holes, or laser holes, may be made in the specific area, or zone, and covering approximately the same surface area, where said only one sound hole would reside. Preferably, the zone covers approximately 8-16 sq. inches, most preferably about 12 sq. inches, of the sound board. The smaller the zone, the deeper and basier the sound. The larger the zone, the higher the frequency. The general area of this "zone" is illustrated in Figure 6, and designated as 50. Examples of potential patterns of holes in the sound zone are illustrated in Figures 7a-c. In Figure

7c the sound hole zone comprises a plurality of pin holes. Additional sound holes in other areas serve only to reduce the surface area of the sound board. While this invention may be embodied in many different forms, there are described in detail herein specific preferred embodiments of the invention. This description is an exemplification of the principles of the invention and is not intended to limit the invention to the particular embodiments illustrated.

In addition to the single sound hole described above, the present invention also includes a novel sound board 22. Typically sound boards comprise a three-ply piece of wood, wherein the separate plies are glued together and laminated on the outer surface. The types of wood and glue that are used for sound boards are well known and need not be discussed further. The three-ply sound boards, due to the three layers of wood and the two layers of glue, have a tendency to sound "dumpy". The present invention employs a solid piece of wood or a two-ply sound board having one glue layer, wherein the grains of the two layers are configured in substantially perpendicular directions. In a two-ply sound board the glue is in the neutral axis with regard to vibration between the two layers of wood. As such, the glue layer is free from significant tension or compression and therefore has very little, as compared to multiple glue lines, effect on the pure vibration of the wood layers. The sound board of the present invention having one solid layer also does not have the dumpy effect found in multiple glue line sound boards.

Figures 4 and 5 illustrate the sound board 22 of the present invention. Figure 4 (sound hole not shown) illustrates the top layer 38 of the sound board 22 with a cut out portion 40 showing the bottom layer 42 of the sound board. The direction of the grain 44 of the top layer 38 is in the opposite direction to the direction of the grain 46 of the bottom layer 42. The perpendicular grains contribute to the stability of the sound board 22 and to the uniformity of the vibration of the sound board.

Figure 5 shows a cross-section of the sound board 22, illustrating the top layer 38, the glue line 48 and the bottom layer 42 (the grain of the bottom layer would not be visible in this end view).

The offset placement of the sound hole, or zone, of the present invention allows for optimum vibration of the sound board 22, which occurs in the middle of the

sound board 22. In conjunction with the placement of the sound hole, the two-ply sound board provides further optimization of the vibration and sound. The use of only a single layer of wood or two layers of wood and one glue line, wherein the grains of the two layers are perpendicularly arranged, reduces the "dumpy" sound of three-ply boards having two glue lines. The combination of the novel hole configuration and placement combined with the two-ply board of the present invention provides superior sound.

In another aspect of the invention, if three layers are used for the sound board, it is preferable, also for the strength of the sound board, that the directions of the grains of the individual layers be non-parallel, while at the same time be in substantially parallel planes, as shown in figure 4. As such, instead of a 90° angle between the grain direction, there could be a 60° angle between the grain directions.

In an alternative feature, wherein the sound board comprises two or more layers of wood, as described above, multiple types of wood may be used. It has been found that using multiple layers of wood for the sound board, wherein each layer is made of a different type of wood, provides a distinctive and unique sound quality. The difference between the compositional makeup, density, elasticity, hardness, softness, etc., of the different layers adds to the unique sound quality. Preferably, two layers are used to avoid an overly thick sound board, which loses its vibration capabilities. Once again, for added strength in the sound board, the grain directions of the separate layers are preferably in parallel planes and are non-parallel. Preferably, at the greatest angle of separation, i.e., 90° for two layers and 60° for three layers.

Types of wood which may be used include spruces, ceders, furs, pines, maples, redwoods, koa, mahogany, berch or popple. However, this list of woods is not exhaustive. If more than two layers are used, one of the types may be duplicated. Preferably, if there are more than one layer of a type of wood, there should be a layer of another type between them. The soundboard may use multiple layers depending on the thickness of the layers. If the layers are relatively thin, more may be used without forfeiting sound quality. The different layers may be of the same or varied thicknesses. Types, arrangement and thicknesses of wood may be chosen based on color and/or final sound qualities since sound and aesthetics are important aspects of the invention, but are

somewhat subjective. Combinations of interest include ceder/spruce and redwood/spruce, however, the invention is not limited to these combinations.

As mentioned above, preferably the direction of the separated grains should not be parallel, but preferably are in parallel planes. Preferably, they are at a 90° from each other. If three layers are included, preferably, there would be a 60° angle between the grains. The angles preferably decrease accordingly with the number of layers. The uniformity of the angles is not required, however, the grain directions should be non-parallel. Providing an angle between the grains provides strength to the final sound board.

The use of multiple species of wood for the sound board may be combined with the novel orientation of the grains, as discussed above, in addition to the novel sound hole placement and the two layer sound board.

The present invention includes each individual above aspect alone or combinations of any of the above aspects, including the sound hole placement, orientation of the grain, the dual layer sound board and use of multiple species of wood, etc. Alone or in varying combination, the aspects add to the quality and/or uniqueness of sound which resonates from the sound board.

Having described specific embodiments of the present invention, it will be understood that many modifications thereof will readily appear or may be suggested to those skilled in the art, and it is intended therefore that this invention is limited only by the spirit and scope of the following claims.

All of the patent, applications or publications referred to above are herein incorporated by reference in their entirety.

The above examples and disclosure are intended to be illustrative and not exhaustive. These examples and description will suggest many variations and alternatives to one of ordinary skill in this art. All these alternatives and variations are intended to be included within the scope of the claims, where the term "comprising" means "including, but not limited to". Those familiar with the art may recognize other equivalents to the specific embodiments described herein which equivalents are also intended to be encompassed by the claims. Further, the particular features presented in the dependent claims can be combined with each other in other manners within the scope

of the invention such that the invention should be recognized as also specifically directed to other embodiments having any other possible combination of the features of the dependent claims. For instance, for purposes of claim publication, any dependent claim which follows should be taken as alternatively written in a multiple dependent form from all prior claims which possess all antecedents referenced in such dependent claim if such multiple dependent format is an accepted format within the jurisdiction (e.g. each claim depending directly from claim 1 should be alternatively taken as depending from all previous claims). In jurisdictions where multiple dependent claim formats are restricted, the following dependent claims should each be also taken as alternatively written in each single dependent claim format which creates a dependency from a prior antecedent-possessing claim other than the specific claim listed in such dependent claim below (e.g. claim 6 may be taken as alternatively dependent from any of claims 2-5, claim 4 may be taken as alternatively dependent from claim 3; etc.).